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POST-TREATMENT EVALUATION OF TURKEY CREEK
DWARF MISTLETOE SUPPRESSION PROJECT
FORT APACHE INDIAN RESERVATION

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POST-TREATMENT EVALUATION OF TURKEY CREEK DWARF MISTLETOE SUPPRESSION PROJECT FORT APACHE INDIAN RESERVATION

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By

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ABSTRACT

A post-treatment evaluation of the 1986 Turkey Creek Dwarf Mistletoe Project on the Fort Apache Indian Reservation was conducted by Forest Pest Management in 1990. Stand summary information from pre- and post-treatment surveys of most treated stands were run through GENGYM growth and yield model. The outputs were compared in order to report on the accomplishment of project objectives. Based on the survey and the model's predictions, three of the four project objectives were accomplished. An even-aged condition was achieved and the model predicts most stands will reach an average stand diameter of 15 inches or greater at the 120 year rotation age. Stand average dwarf mistletoe ratings were reduced from 1.4 - 2.1 to 0.6 - 1.1. This decrease probably contributed to the model predicting a slightly higher board foot sawtimber volume per acre at rotation due to treatment. It does not appear that many disease-free seed trees will be available at regeneration due to the high level of infection in the residual stands. However, early regeneration cuts in some of the stands are recommended in order to utilize lightly infected seed-producing trees which can be removed after a new stand has become established.

INTRODUCTION

In July 1990, Don Washco of the Bureau of Indian Affairs (BIA), Fort Apache Agency, requested a post-treatment evaluation of the 1986 Turkey Creek Dwarf Mistletoe Suppression Project on the Fort Apache Indian Reservation. The project was designed to show the effects of using intensive silvicultural prescriptions to control southwestern dwarf mistletoe (DM) in ponderosa pine. Forest Pest Management (FPM) personnel, from the Arizona Zone office, visited the site with Don and a survey crew collected data from treated stands in the southern section of the project area (Figure 1). The purpose of this evaluation is to assess the achievement of project objectives.

METHODS

Stands designated 1DF, 2D, 3F, 3G, & 4A were surveyed during this analysis. The Fort Apache Agency had previously collected post-treatment data from Stands 2B and 2C which were also analyzed. Three other stands treated during the project were not included at this time. Diameter at breast height (DBH) and dwarf mistletoe rating (DMR) (Hawksworth's 6-class system) were recorded for all ponderosa pines located on variable radius plots. A basal area factor (BAF) of 10 was used in all stands. The height of 3 trees in each diameter class throughout the stand were recorded. Either a 8 x 4 chain or a 4 x 4 chain grid was used, corresponding to the grid of the pre-treatment survey (Table I). The original pre-treatment data and final post-treatment data were used for growth and yield projections with GENGYM.

Table I. Stands and Grid Pattern

8 X 8 Chain	4 X 8 Chain
3F	1F
3G	2E
4A	1D

PROJECT OBJECTIVES

The original silvicultural treatment alternatives were developed and refined using RMYLD, a simulated growth and yield computer program for southwestern ponderosa pine. Management objectives which drove selection of treatment alternatives included:

1. Initiate even-aged management.
2. Reach an average stand DBH of 15 inches within a rotation age of 120 years.
3. Naturally regenerate these stands using a two-step shelterwood system and mistletoe-free seed trees.
4. Limit losses caused by DM while maximizing the board-foot volume yield of the stand over the rotation.

SILVICULTURAL PRESCRIPTION

The initial Turkey Creek Project proposed to treat 1,577 acres, consisting of 17 stands. Stand differentiation was based on stand structure, stocking density, and DM intensity. The project was later modified to a two-phase project; 950 acres were treated in 1986 - 1987, 418 acres were deferred for 10 to 20 years, and the remaining acres were removed from the project because they were inoperable.

The basic silvicultural prescription for all stands was an overstory removal (OR) of 11+ DBH size trees, followed by a pre-commercial thin (PCT). Originally, a few stands were prescribed for seedtree cuts, but changes were made such that some stands were deferred and others were prescribed for an OR followed by a PCT (Table II). Forest Pest Management funds were used to pay for pulpwood removal and slash disposal.

The overstory removal, and PCT treatments were marked simultaneously but with separate guidelines. All infected and uninfected trees over 11 inches DBH were to be marked for removal. However, trees in these size classes were left where stocking was a great concern. Selection of leave trees in the precommercial thinning were based on the following factors listed in order of relative importance: amount of DM infection; dominance; vigor and risk; spacing; and form. Leave trees were to be free of DM in the upper third of the crown and free of bole infections. Due to severe DM infection (Table III), severely infected trees were to be left behind for stocking purposes. However, large openings were anticipated and a 51 percent stocked residual stand was considered acceptible.

Table II. Proposed and Actual Silvicultural Treatments of Project Area.

Stand	Proposed tmt[a]	Actual tmt
1A, 1B, 1D, 1F	OR/PCT[b]	SAME
2A, 2B, 2C, 2D	OR/PCT	SAME
3F, 3G	OR/PCT	SAME
1C, 1E, 3D	OR/PCT	DEFERRED
1G, 3E	SC[c]	DEFERRED
4A, 3C	SC	OR/PCT

[a] tmt = Treatment
[b] OR = Overstory removal; PCT=Precommercial thinning
[c] SC = Seedcut

PRESENT STAND CONDITIONS

Due to the uniformity in prescriptions and original stand conditions, most of the treated stands in this project area are similar. The stands are fairly evenaged with the majority of trees between 7 to 12 inches DBH. Although the prescription called for removal of trees greater than 11 inches DBH, most of the stands average about 20 trees per acre in these size classes. Dwarf mistletoe ratings and stocking densities of pre- and post-treatment conditions are given in Table III. These were reduced but remained similar between most stands. Stand average DM ratings range from .6 to 1.1. Distribution of DM infection is patchy.

All stands except 3G have similar densities and volumes. Stand 3G with an average DMR of 1.1, has the lowest density and volume with only 13 square feet of basal area per acre (BA) and 624 board feet of sawtimber per acre (BFS). Basal areas of the other stands range from 36 to 63, and BFS volumes from 1,662 to 2,197. As anticipated, the project created some fairly large openings. In a few areas, intensive fires from slash treatments killed some of the residual trees.

TABLE III. Pre-treatment and Post-treatment Stand Conditions.

STAND ID	Pre-treatment			Post-treatment		
	BA[a]	BFS[b]	DMR[c]	BA	BFS	DMR
1DF	91	7337	2.1	53	2197	1.1
2B[d]	96	4659	1.7	36	1662	0.6
2C[d]	75	3671	1.7	42	1767	0.9
2D	94	5130	2.0	42	1801	0.8
3F	85	4700	1.4	63	2120	0.8
3G	65	6380	1.5	14	624	1.1
4A	95	4890	1.8	43	2120	1.1

[a]**BA = Square feet basal area per acre.**
[b]**BFS = Board foot sawtimber volume per acre.**
[c]**DMR = Average stand dwarf mistletoe rating.**
[d]**Stands surveyed by Fort Apache Agency of the BIA.**

GENGYM MODELING

Pre- and post-treatment data were used in GENGYM modeling to predict the outcome of various management alternatives. A no treatment alternative and a treatment simulating the actual harvest were used with the pre-treatment data. The results were compared with the actual post-harvest data. The stand DMR's were reduced by the actual treatment and were lower than the predicted levels when the overstory removal was set at the minimum 11 inch diameter limit. Since there were quite a number of trees greater than 11 inches DBH after treatment a simulation of a minimum 18 inch diameter limit for overstory removal followed by a pre-commercial thin was made. This showed that having a broader range of diameter classes in the residual stand from which to clean out the more severely infected DM-infected trees allowed for a greater drop in the stand DMR. However, the actual stand DMR's were still lower than predicted values.

GENGYM growth and yield model predictions of pre- and post-treatment data are shown in Table V. At the 120 year rotation age, and in the absence of the 1987 treatment, stand average DMR's greater than five are expected, average diameters range from 11 - 17.3 inches DBH, and BFS volumes range from 5,726 to 12,328. There is not a great deal of difference in predictions with post-treatment data. Average DMR's greater than 3.8 are expected for all stands by the 120 year rotation age. Predicted average diameters at breast height range from 13.2 to 17.5 and the BFS volumes range from 6,412 to 14,487 board feet at final harvest. By adding the previously harvested volumes to the expected volumes at rotation the model predicts the 1987 treatment increased the volume through rotation in most stands. An extreme decrease in volume is shown for stand 3G. This is not surprising since the post-treatment data survey showed a severe decrease from the pre-treatment survey. The difference may be due to survey techniques or to a change in boundaries between the two surveys since a significant section of the stand had been deferred from treatment.

TABLE V. Predicted Stand Conditions at Rotation Age (120 years) With and Without Treatment.

STAND ID	Without Treatment Average DBH[a]	BFS[b]	DMR[c]	With Treatment AVERAGE DBH	BFS	DMR
1DF	17.3	11555	4.9	16.2	11881	4.9
2B	11.0	11299	5.4	13.2	11570	3.8
2C	11.0	8058	5.6	14.1	11334	4.6
2D	14.8	10150	5.5	15.4	10768	4.4
3F	12.0	5726	5.2	17.7	14487	3.8
3G	13.6	12328	5.1	16.1	6412	4.3
4A	13.1	10925	5.3	17.5	10811	4.8

[a]**DBH = Average stand diameter at breast height.**
[b]**DMR = Dwarf mistletoe rating.**
[c]**BFS = Board foot sawtimber volume per acre.**

Due to the level of infection in the residual stand, an adequate number of disease-free seed trees are not anticipated at the 120 year rotation age. However, information from the model was used to determine when stands would have an adequate number of seed trees with DMR's of three or less, and could be regenerated early. (Trees with DMR's greater than three are poor cone and seed producers.) This was done by determining when a stand would have approximately 40 BA of trees greater than 13 inches DBH with an average DMR of less than 3 (Table VI). A 40 BA is recommended for regenerating poor sites such as the rocky ridge tops in the Turkey Creek Project. The model indicates that stands 2D, 3F, and 4A will be ready for the regeneration cut in 2000, while stands 1DF, 2B, and 2C will be ready in 2010. In stands 2D and 4A a lower BA was used during the year 2000 because the DMR was increasing too rapidly to wait until 2010. The outlook for stand 3G with its current BA of 13 appears grim. By the time the BA is adequate in the higher size classes the DMR is too high to expect viable seed trees.

TABLE VI. Year Regeneration is Recommended Based on Basal Area and Average DMR of Trees Greater than 13 inches DBH.

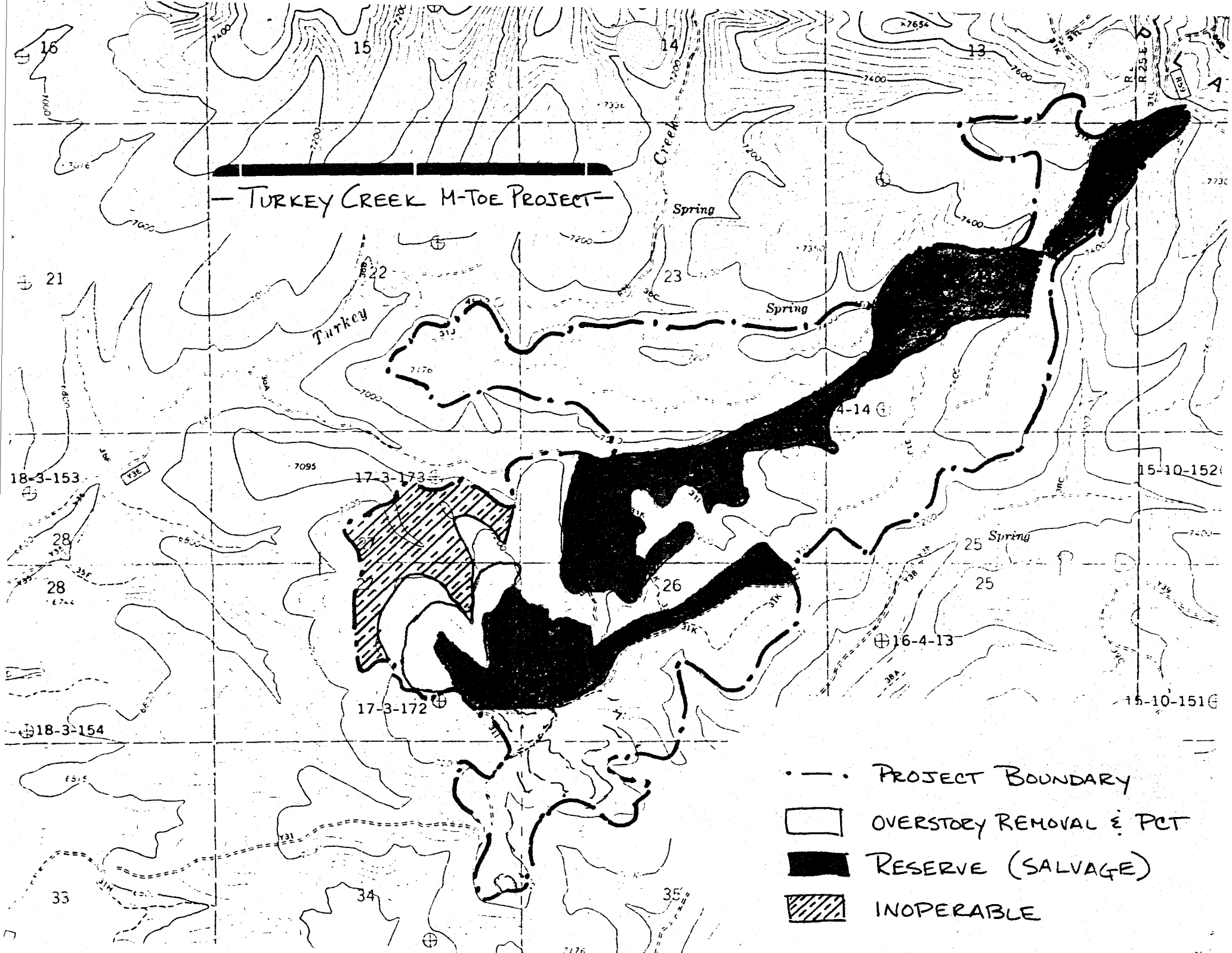
STAND	YEAR	BA	DMR
1DF	2010	45	2.8
2B	2010	42	1.3
2C	2010	38	2.2
2D	2000	33	1.8
3F	2000	49	.8
3G	2030	40	3.7
4A	2000	31	1.9

All GENGYM outputs referred to in this document were sent to the Fort Apache Agency BIA Office and can be obtained from the Arizona Zone FPM office.

ACCOMPLISHMENT OF PROJECT OBJECTIVES AND RECOMMENDATIONS

A desirable condition for the area is to create relatively disease free stands. The four objectives listed above were designed to meet this condition. All but one objective was met. The first objective to create an even-aged condition was achieved and the majority trees in each stand are in diameter classes ranging from 7 to 12 inches DBH. GENGYM model predictions were used to indicate success or failure of the second, third, and fourth objectives. The second objective was to reach an average stand diameter of 15 inches or greater at the 120 year rotation age. The model predicts this will be achieved for all stands due to treatment, but would not have happened in the absence of treatment. It is doubtful the third objective of having DM-free seed trees available at regeneration is possible due to the high DM levels in the residual stand. However, in order to insure an adequate number of seed trees with DMR's of three or less which can produce viable seeds, an early shelterwood seed cut is recommended for selected stands. As shown above, GENGYM output was used to indicate the year different stands would meet the 35 to 40 BA requirement of trees greater than 13 inches DBH. Most of the stands could be regenerated in the next 10 to 20 years, but site quality and size of treatment areas should also be considered. Stand 3G should probably be deferred and left to convert to oak since pine stocking is low and DM infection is high. The trees will need to be removed as soon as regeneration becomes established. The fourth objective to limit losses caused by DM while maximizing the board-foot volume yield of the stand over the rotation could only be addressed with GENGYM predictions. In comparing pre-treatment conditions with post-treatment conditions the model predicts volumes will be greater in most stands due to the 1987 treatment. The increases are small but the most important goal is to reduce the level of infection so the stand may be regenerated later with viable seed producing trees. Although the DMR of the residual stands is considered high, it was reduced significantly in all treated stands. It appears that three out of the original four project objectives have been achieved. Some success is based solely on GENGYM predictions and will need to be validated over time.

The residual stands still have quite a number of trees greater than 11 inches DBH which were prescribed for removal. This was probably beneficial to the residual stand because typically the healthier trees in these age classes were left behind, allowing removal of more severely infected trees in the smaller diameter groups. It appears that early shelterwood seed cuts could have benefited some stands during the 1987 treatment especially since they were cut back to nearly 40 BA which is advised for regeneration cuts on poor sites. These stands had enough uninfected to lightly infected seed producing trees (greater than 15 inches DBH) before treatment. Although the original project proposal considered different prescriptions, only one was selected for all 950 treated acres. In the future a variety of treatment alternatives should be prescribed for an area this large. In addition to creating diversity, the effects of different treatments on a variety of soil, topographical, disease, and other conditions can be observed.


TURKEY CREEK M-TOE PROJECT
Turkey Creek
Spring
Spring
Spring
18-3-153
17-3-173
17-3-172
18-3-154
16-4-13
15-10-152
15-10-151
PROJECT BOUNDARY
OVERSTORY REMOVAL & PCT
RESERVE (SALVAGE)
INOPERABLE